Arkwood Ground Water Path Forward Review

Updated: September 15, 2015

For dioxin reassessment/colloidal transport:

- Implement additional dye test at a time of high flow through the karst system, which would occur at or near the time of peak discharge from New Cricket Spring, and sample the spring discharge at New Cricket Spring for both dioxin and PCP.
- If colloidal transport is occurring, dioxin levels may exceed standard for groundwater, warranting an extensive search for possible destinations. Additional wet-weather (peak discharge) sampling points could include seeps and discharges along Old Cricket Road across from the treatment plant northwest of the site, along railroad track north of the site, and inside the railroad tunnel northeast of the site.
- Implement monitoring well(s) at depth, as well as, shallow monitoring wells north of and/or at lower elevations than New Cricket Spring.

For the five year review:

- Implementation dual purpose will assist protectiveness determination on whether an unacceptable amount of underflow or bypass flow is occurring with attendant contaminant transport, both solute (PCP) and colloidal (dioxin).

Rationale:

McKesson, the PRP, conducted a tracer study in November 2014-January 2015. The test was conducted at or near base flow from New Cricket Spring. For New Cricket Spring, dye was seen shortly after injection, and dye concentrations peaked within a day. For Cricket Spring, no dye was observed discharging.

However, only about 45 percent of the dye mass was recovered, leaving unaccounted about 55 percent dye mass. EPA and ADEQ asked:

- Did dye discharge to depth in the karst system?
- Did dye migrate horizontally or flow at a slightly lower elevation in a way that bypassed New Cricket Spring?

McKesson, and their ground water support contractor Ozark Underground Laboratory, Inc., attributed the unaccounted dye mass to "immobile porosity". However, McKesson and Ozark did not present any analysis supporting this hypothesis, rendering the attribution to immobile porosity speculative.

In addition, after the dye test and during a site visit in May 2015, seeps and discharges were observed by EPA and ADEQ on the northeast side of Old Cricket Road (across the road and downhill from New Cricket Spring), as shown in Photo No. 1 and near the Northwest portal of the railroad tunnel (just north of the site), in the area shown in Photo No. 2. These seeps are visual evidence of bypass flow and they indicate that not all water in the system discharges from New Cricket Spring.

Thus, the potential discharge to depth and bypass flow (under and beyond New Cricket Spring) continues to be of utmost concern for EPA HQ, particularly with respect to overall protectiveness of the groundwater remedy (Scott Huling/EPA ORD). EPA HQ has also identified that a conclusion on colloidal transport must be completed as part of the dioxin reassessment (David Bartenfelder/EPA

OSRTI). Therefore, EPA will require McKesson to conduct an additional dye test at a time of high flow through the karst system, which would occur at or near the time of peak discharge from New Cricket Spring, and sample the spring discharge at New Cricket Spring.

Testing at peak discharge serves the contaminant transport evaluation in several ways:

- sampling and analysis of the turbid discharge of New Cricket Spring will allow direct determination of whether colloidal transport of dioxin is occurring;
- open karst pathways at higher elevations than base groundwater levels will saturate as the water table rises in response to a peak event, and other spring discharges and ground seeps will be available to check for dye and colloidal transport; and,
- peak flow may result in horizontal bypass flow or discharge to depth as the water levels rise on site and the hydraulic gradients are increased, so peak flow dye tests will provide a means of evaluating contaminant transport in karst during periods of greatest expected transport potential.

Also, in order to check for bypass flow and colloidal transport at depth in the karst system, EPA will require monitoring wells at depth, as well as shallow monitoring wells north of and at lower elevations than New Cricket Spring. These wells will provide a better idea where the missing 55 percent of dye mass may be discharging (other than that lost to immobile porosity, if any). Adding these wells will also provide information regarding the protectiveness of the overall ground water remedy, which is timely since the next five year review is due in FY2016. Bypass flow creates a situation where groundwater impacted with PCP above the MCL, and potentially with colloidally transported dioxin, may be avoiding the point of groundwater capture, thereby creating a condition where exposure could occur. In essence, if underflow or bypass is occurring, colloidal dioxin or PCP as solute could be transported past New Cricket Spring and the treatment facility at that location.

Conclusion:

Currently, a conceptual ground water model of complete capture of the solute plume at Arkwood by New Cricket Spring forms the basis for the ground water remedy. However, seeps and other discharges were observed in May 2015 by EPA and ADEQ and this observation indicates New Cricket Spring is being bypassed to an unknown extent. Thus, implementing an additional dye test at high flow and requiring additional monitoring wells will increase the ability to monitor karst flow and spring flow. This will provide information regarding the effectiveness of capture by New Cricket Spring and help establish whether an unacceptable amount of underflow or bypass flow is occurring with attendant contaminant transport, both solute (PCP) and colloidal (dioxin).


North
Eagle View Dr
Seeps along road
(Photo 1)
College Rd W
College Rd
New Cricket Spring
Seeps along rail
road tracks
(Photo 2)
Arkwood Site

Photo No. 1. May 19, 2015. View to the southeast, up Old Cricket Road, between Cricket Spring and New Cricket Spring. Water seeping from ground on northeast side of road is flowing in the ditch at the edge of the road, over 48 hours after a 0.50-inch rainstorm. Discharge from New Cricket Spring treatment plant is on the opposite side of the road.

Photo No. 2. May 19, 2015. View to the southeast at northwest portal of railroad tunnel, immediately north of Arkwood site, with water seeping from ground on right side of railroad near portal.